

U.S. Department of the Interior

Annual Report on Prize Competitions

FY 2016 Activities

June 2017

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I. Summary

This report is submitted to the Office of Science & Technology Policy in support of the 2016 Annual Report on Prize Competitions under the America COMPETES Reauthorization Act of 2010 (ACRA) [15 USC § 3719(p)], an amendment to the Stevenson-Wydler Technology Innovation Act of 1980 (PL 96–480). This report highlights the fact that the Department of the Interior (Department) is actively engaged in further developing and using its capacity to offer prize competitions under the authorities provided within ACRA, as well as other authorities, in order to stimulate new, and advance existing, technologies, and identify and develop new ideas to address our mission needs. Specifically:

- The Bureau of Reclamation (Reclamation) [Water Prize Competition Center](#) (WPCC) established in FY 2015 continues to lead several interagency efforts to develop new, or improve existing, technologies to increase water availability, improve infrastructure sustainability, and ensure sustainable ecosystems. By the end of FY 2016, the WPCC had initiated five competitions, of which four had been completed. Collectively, these 5 competitions awarded a total of \$110,000 in prizes dispersed across 23 winning solutions.

The estimated value of the problem solving efforts made by all competing solvers for these 5 competitions is \$1,010,000, an approximate 10:1 return on the prize purse investments. Many solutions did not receive awards although they did include promising concepts or ideas. As a result of the competition rules, the Federal Government received licenses to use 175 of the concepts/ideas submitted by solvers from four of these competitions even if their solutions were not awarded a cash prize. For these four competitions, participants agreed to grant the Federal Government a license to use their ideas in exchange for guaranteeing that the prize purse would be awarded to the best solutions submitted.

- Reclamation initiated the design of six additional prize competitions scheduled to launch during the first half of FY 2017. These competitions seek new ideas but also include seeking prototype solutions that are near operational ready. The collective total of the prize purses for these initial six competitions in FY2017 is \$1,180,000
- Reclamation was awarded the *Newcomer of the Year* and *Best in Technology* prizes in October 2015 to commemorate the 5-year anniversary of *Challenge.gov* for, among other things, establishing the WPCC and developing federal partnerships to advance technologies that improve water resource management. In addition, Saied Delagah, a Reclamation desalination research expert, received the *Unsung Hero* award for his outstanding behind the scenes coordination of the technical efforts that enabled the Desal(ination) Prize.
- The United States Geological Survey (USGS) is cooperating with Reclamation on many of the challenges sponsored by the Water Prize Competition Center's efforts. USGS also partners with EPA and other Federal and non-Federal agencies on the Nutrient Sensor Challenge, which is an effort to accelerate development and commercial availability of affordable, reliable, and accurate sensors to measure nutrient levels in aquatic environments. In general, its personnel offer technical assistance, data support, judging services and, where appropriate, site access and testing services.

- The National Park Service (NPS) conducted a prize competition in conjunction with the National Capital Planning Commission (NCPC) and Van Alen Institute for *Memorials for the Future*, an ideas competition to reimagine how Americans may think about, feel, and experience memorials in the future.
- The Bureau of Land Management (BLM) has placed efforts on hold for a prize competition that would help address the challenge of applying fertility control vaccines to manage healthy wild horse and burro populations on public lands. It is possible that a Congressionally-created Foundation to support the BLM, would be able to raise private funds for this prize. Currently, available fertility control technologies are limited in their effectiveness due in part to the logistical challenges of consistently locating, identifying, tracking, treating and retreating the wild horses and burros. A solution to this challenge is critical because wild horse and burro herds have a rapid growth rate when left unchecked, annual adoptions of excess animals are at a near-record low, the cost to care for excess animals in BLM-funded off-range corrals and pastures is unsustainable, and wild horse and burro populations on the range are well over the appropriate management level.

In addition, bureaus offer prize competitions to advance their missions using authorities other than ACRA:

- The United States Fish and Wildlife Service (FWS) announced the winners of the Crushed Ivory Design Challenge, a prize competition it offered under its general authority to conserve wildlife species. This competition invited entrants to propose powerful visual concepts for public displays of crushed ivory from the U.S. ivory crushes. It is expected that the ideas of the winners — Kelly Lance of Monterey, Calif., and Jacqueline Nott of Auburn, Calif. — will be transformed into three dimensions by building their designs and identifying publicly accessible venues with high visibility to display the exhibits.
- The Bureau of Safety and Environmental Enforcement (BSEE) launched a multi-year initiative to promote education in science, technology, engineering and mathematics (STEM) while also engaging and raising its profile with these segments of the future workforce. The first competition under this initiative was for the best adaptation for offshore use of a piezoelectric technology developed by NASA. The competition, which was offered under its general authority to promote safety, protect the environment, and conserve resources offshore, was jointly sponsored by BSEE and the Ocean Energy Safety Institute (OESI),

The above competitions have helped the Department and the various bureaus build a body of knowledge and cadre of experts to efficiently and effectively manage and administer prize competitions as an additional tool in fulfilling Departmental goals and missions.

The following provides greater detail on bureaus' prize competition related activities, with the focus on challenges where DOI bureaus are the lead sponsors.

II. Bureau Activities on Prize Competitions under ACRA

Bureau of Reclamation

Prize Competitions Launched during FY 2016. Reclamation's Water Prize Competition Center launched four new prize competitions during FY 2016:

1. Quantifying Drift Invertebrates in River and Estuary Systems;
2. Downstream Fish Passage at Tall Dams;
3. Detecting the Movement of Soils (Internal Erosion) Within Earthen Dams, Canals, Levees, and their Foundations; and
4. Preventing Rodent Burrows in Earthen Dam, Canal, and Levee Embankments.

All four of these competitions consisted of ideation challenges where Reclamation was seeking new and better concepts to tackle persistently tough problems. Reclamation collaborated with multiple Federal agencies to design and judge each competition, and expanded its collaboration to include state agencies, namely the States of Colorado and California.

The prize competition approach enabled Reclamation to engage individuals with impressive credentials that work in other technical domains. The ability to solicit solution concepts from the broader public demonstrated the merit of prize competitions to introduce new or improved ideas into the thinking of our subject matter experts, and stimulated Reclamation's thinking about other ways to make some of these ideas work.

Many of the awarded solutions had not been previously considered by Federal subject matter experts while other awarded solutions offered improvements to existing methods. Although each solution offered novel elements, each will also require additional development and testing before the merit can be fully accessed. The need for additional development and testing is expected for prize competitions that seek new ideas.

Appendix A includes the details for each of these competitions required by the *Guidance to Federal Departments and Agencies for Fiscal Year 2016 Report on the Use of Prize Authority in the America COMPETES Reauthorization Act* issued by the White House Office of Science and Technology on September 23, 2016.

Prize Competitions Planned for FY 2017. Design work began on several prize competitions planned to launch early in FY 2017.

- **Arsenic Sensor - Stage 1, \$50,000 prize purse.** Measuring arsenic in the environment and in drinking water is important for protecting human health. Drinking water and wastewater treatment facilities are subject to arsenic regulations to limit human exposure and environmental contamination. While current analytical methods are suitable for ensuring regulatory compliance, there is a need for rapid, low-cost monitoring of arsenic that would benefit water treatment plant operations, wastewater monitoring, contaminated site remediation, private well owners, scientific research, and other interested parties.
<https://www.usbr.gov/research/challenges/arsenicensor.html>.

- ***More Water Less Concentrate - Stage 1, \$150,000 prize purse.*** Currently, significant and desirable water supplies are trapped in concentrate streams that are a byproduct of desalination technologies. The cost to manage or dispose of concentrate is rather large, which limits utilization of desalination in inland applications. This challenge is seeking innovative concepts to expand usable water supplies by maximizing fresh water production from inland desalination systems, and thereby reduce the volume of concentrate.
<https://www.usbr.gov/research/challenges/morewater.html>.
- ***Sub-Seasonal Climate Forecast Rodeo, \$800,000 prize purse.*** Improved sub-seasonal forecasts for weather and climate conditions (lead-times ranging from 15 to 45 days and beyond) would allow water managers to better prepare for shifts in hydrologic regimes such as the onset of drought or occurrence of wet weather extremes. Participants will be required to submit their forecast for precipitation and temperature for the Western U.S. every two weeks over the course of one year. Recognizing the National Oceanic and Atmospheric Administration (NOAA)'s leadership and role in forecasting, Reclamation has partnered with NOAA on this competition. In addition to technical expertise, NOAA is hosting an online leader board to track participant forecast against NOAA's official forecast and what actually occurs. To be eligible for prizes, solvers demonstrating skillful performance will be required to submit documentation of their forecast technique.
<https://www.usbr.gov/research/challenges/forecastrodeo.html>
- ***Estimating Reservoir Water Storage Capacity, \$75,000 prize purse.*** Sediment deposition in reservoirs — or the accumulation of particles like pebbles, sand, and mud carried by wind, water, or ice — limits the active life of reservoirs by reducing storage capacities and impacting structures, such as water outlets and intakes. Developing an efficient and accurate indirect estimate model of reservoir storage would result in a significantly better, faster, and cheaper solution and support Reclamation in meeting water and power deliveries now and into the future. <https://www.usbr.gov/research/challenges/waterstorage.html>
- ***Mobile App Framework for Field Data Capture, \$30,000 prize purse.*** Data collection is fundamental to water and environmental management. Development of a flexible, extensible, and open source data collection app framework for mobile devices will facilitate the use of mobile devices for field data collection. This, in turn, will improve data collection efficiency, lower data collection costs, and improve data quality, transparency, and dissemination for applications to management, decision making, and scientific discovery.
<https://www.usbr.gov/research/challenges/dataapp.html>
- ***Long-Term Corrosion Protection of Existing Hydraulic Steel Structures – Stage 1, \$75,000 prize purse.*** How can we protect immersed steel structures from corrosion in a manner that provides fifty or more years of service life without significant maintenance or replacement of the protection method? This challenge will be seeking long term corrosion protection for large, immersed hydraulic steel structures beyond the current protections provided by coatings and cathodic protection. The goal is 50 years of protection with minimal maintenance and low cost of installation.
- ***Advanced Water Treatment Series of Grand Challenges.*** Reclamation requested an additional \$5.5 million for prize competition in the FY 2017 budget request, with the majority of the increase for funding a series of Grand Challenges to spur innovation in advanced water treatment technologies. The objective will be to identify and overcome the cost, energy, and other barriers that are currently limiting a more widespread use of advanced water treatment technologies to expand useable water supplies. Although both the House and

Senate have approved the FY 2017 request, plans for full implementation are pending a FY 2017 enacted budget. However, under existing appropriation for prize competitions, Reclamation started Stage 1 of More Water Less Concentrate (see above paragraph) as the first competition in this series of Grand Challenges.

Grand Challenge prize competitions consist of multiple stages that collectively span several years and culminate in a full-scale, head-to-head competition in an operational setting. The size of the prizes typically offered escalate as the competition advances through each stage of the competition. Grand Challenge competitions strive to achieve transformative impacts for Reclamation and for the broader water resources community of practice.

<https://www.usbr.gov/research/challenges/upcoming/GrandChallengePPT.pdf>

Federal Collaborations. During FY 16, Reclamation continued its efforts to build collaborations with and train subject matter experts from other Federal Agencies that have a stake in water and water related resources. It completed a 2-year effort to provide training on prize competitions for other Federal agencies with a stake in each of the theme areas under our Water Prize Competition Center. These efforts have been instrumental in building informed Federal collaborations. Each competition benefits from having a broad Federal cross-section of subject matter experts collaborating on various aspects of each challenge such as designing, judging, and promoting the competition.

Non-Federal Collaborations. During FY 2016, Reclamation also initiated efforts to recruit non-Federal collaborators. In July 2016, it published a notice on FedBizOpps seeking non-Federal partners to help launch prize competitions and also began actively reaching out to the non-Federal organizations. The various ways non-Federal partners can collaborate include contributing:

- Prize Purse Money
- Technical Experts
- Judges
- Testing Facilities
- Promoting the Competition to Public and Solver Communities
- Commercialize Winning Solutions
- Prize Competition Administration

As a result of this effort, Reclamation entered into an agreement with Xylem Inc., a global water technology company, to collaborate on two prize competitions. Xylem will contribute to the prize purse as well as subject matter experts to help design and judge competitions. Xylem will also be able to broker business deals with competitors to commercialize their solutions and thereby accelerate the process of spurring innovation into market ready products. These products can serve the water resources community while driving the economy and creating jobs. Reclamation is in the process of negotiating additional collaborations and reaching out to others. Continuing to build non-Federal collaborations will be an emphasis for FY 2017.

Prize Competition Project Management Core Competencies. Three technical staff in Reclamation's Technical Service Center now have experience managing a prize competition project from beginning to end. An additional three staff members are currently managing prize

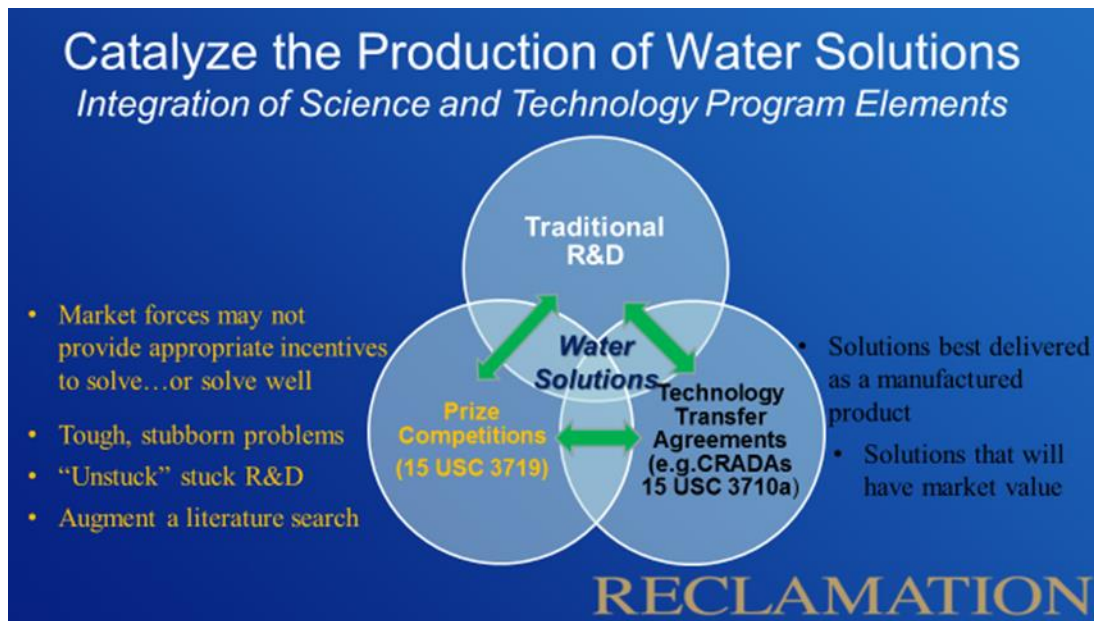
competitions that will be launched in FY2017. Reclamation’s strategy is to build prize competition core competencies in a cross-section of subjects so that subject matter experts are positioned to manage and mentor prize competitions in the future. In addition, they will also be trained to recognize opportunities where prize competitions are well suited to help solve Reclamation problems as part of their normal technical and engineering work responsibilities.

Integration of Prize Competitions with Traditional R&D and Technology Transfer.

Reclamation’s Science and Technology Program funds three primary program elements:

- Traditional Research and Development
- Prize Competition Authority (15 USC 3719)
- Technology Transfer Authority (15 USC 3710a)

All three elements are tools to spur innovation and transform it into solutions for Reclamation water and water related resources managers, our stakeholders, and the larger water resources community of practice. Reclamation considers them to be complementary tools that are able to accomplish more when used collectively than separately.



Knowledge gained from traditional R&D can be used to inform the design of a prize competition. Additionally, the knowledge gained from a prize competition can inform the next steps of traditional research. Prize Competition authorities provide a tool that solicit ideas, concepts, and solutions from the public. With the world connected through the internet, prize competitions are an effective tool that allow all the smart people in the world to help solve our problems. Prize competitions can be especially effective for the use cases shown in the figure.

The primary tool authorized by Technology Transfer authorities is the Cooperative Research and Development Agreement (CRADA). A CRADA is simply the legal agreement that allows Federal agencies to team-up with the private sector, combine their resources, and pursue solutions of mutual interest. CRADAs also provide the ability to protect partner, federal, and

mutually developed intellectual property. CRADAs are especially applicable to the use cases shown in the figure.

CRADA authorities and Prize Competition authorities can also be used in complimentary ways to accomplish more together than either authority can do on its own. In July 2016, Reclamation presented various complimentary approaches to using CRADA and Prize Competition authorities to the Challenge.gov Community of Practice. Reclamation plans to educate our collaborative research communities about the attributes of each tool. This will enable researchers to better plan the overall R&D workflow to strategically use these tools for solving water problems and delivering the solutions to the end-user.

United States Geological Survey (USGS)

In FY 2016, USGS participated in several prize competitions and related activities in conjunction with other agencies within and outside the Department. In each of these, the USGS role typically consists of providing technical and scientific expertise to help judge submissions, familiarize participants with and provide access to USGS data, helping develop the challenge design, helping identify best challenge practices, and supplementing, where necessary and appropriate, prize purses. Following is a brief summary of these challenges, related activities and significant outcomes to date.

Water Prize Competition Center. The USGS is cooperating with the Bureau of Reclamation's Water Prize Competition Center (see above) to identify, coordinate, and run multiple challenges centered on water availability, ecosystem restoration, and infrastructure sustainability. The Columbia River Research Laboratory, within the USGS Western Fisheries Research Center, has supported Reclamation's efforts to establish prize competition processes, and launch the initial prize competition seeking New Concepts to Remotely Track Fish. Subject matter experts from Reclamation and the USGS Columbia River Research Laboratory co-led the prize competition design and judging for this initial challenge and are actively working as part of the design and judging teams on other aquatic ecosystem restoration prize competitions.

USGS scientific and technical personnel are also participating in the water availability theme area and are currently collaborating on the *Sub-Seasonal Climate Forecast Rodeo, Estimating Reservoir Water Storage Capacity, and the Mobile App Framework for Field Data Capture prize competitions described under the Reclamation section of this report.*

Nutrient Sensor Challenge. The USGS is a partner with EPA and other Federal and non-Federal agencies on the Nutrient Sensor Challenge, which is an effort to accelerate development and commercial availability of affordable, reliable, and accurate *in situ* nutrient sensors in aquatic environments. The coalition of federal agencies, universities, and non-profits is bringing incentive prizes and open innovation to the problem of nutrients. In addition to providing technical expertise, the USGS has partnered directly with the University of Maryland's Alliance for Coastal Technology — funded by NOAA and leading the Challenge testing — to further evaluate sensor performance in riverine settings. In particular, the USGS provided site access and technical expertise in the development of the testing infrastructure, and will work with the Alliance for Coastal Technology and other partners on future sensor testing.

National Park Service (NPS)

NPS initiated a prize competition in partnership with the National Capital Planning Commission (NCPC) and Van Alen Institute for *Memorials for the Future*, an ideas competition to reimagine how future Americans may think about, feel, and experience memorials. This competition was initiated as part of the National Park Service 2016 Centennial. The National Park Service Centennial challenged NPS to think about new ways to engage the next generation and tell stories relevant to them. *Memorials for the Future* challenged NPS to think about how to take the imagination displayed in this ideas competition and use it to spark a new generation of national park visitors, supporters and advocates, not to mention artists, architects and philosophers.

The competition took place over the course of six months, from March to September 2016. The competition launched with the release of an international request for qualifications. Submissions came from around the world and represented the ideas and work of over 300 participants. From the submitted proposals, 30 semifinalists were identified. Four finalists with innovative and distinct approaches were then chosen by the judges. The finalist teams American Wild, Climate Chronograph (the competition winner), The Im(migrant), and VOICEOVER developed their proposals over the course of three months. Together, their final proposals helped NPS to think about new ways to commemorate and showcase new opportunities that go beyond the boundaries of the existing memorial landscape. Though these proposals present exciting possibilities for future memorials, none will actually be built as part of the competition. The proposals presented ways to engage diverse new subject matter, allow for reinterpretation over time, enable and respect multiple narratives, consider technology, and honor national contexts and local experiences. They developed designs that can adapt and evolve, are sometimes ephemeral or temporary, and often engage the public directly as part of the memorial. Additional information on this challenge is available at: future.ncpc.gov. A free public exhibition showcasing the winner and finalists' design concepts opened September 8, 2016, in the Hall of Nations at the John F. Kennedy Center for the Performing Arts and ran through October 20, 2016.

Climate Chronograph, the winning concept, is a forward-looking memorial that takes a complex global process—climate change—and turns it into a tangible, personal experience. While memorials conventionally commemorate a moment in the past, this initially traditional-looking memorial offers a reimagined landscape and a living observatory that allows people to interact with the space as it evolves unpredictably over time.

The other three finalists were each recognized with honorable mentions: American Wild: A Memorial (Honorable Mention for Marrying the Ephemeral and Iconic); The Im(migrant): Honoring the Journey (Honorable Mention for American Heritage and Community); and VOICEOVER (Honorable Mention for Futurism and Reinterpretation).

The most compelling and relevant themes and trends from the competition were summarized in a findings report titled, *Not Set in Stone: Memorials for the Future*. These ideas, which include engaging the present and future as much as the past; allowing for changing narratives; and considering ephemeral, mobile and temporary forms; may be used by organizations, planners and designers to inspire contemporary approaches to 21st-century memorials.

Bureau of Land Management

One of BLM's goals is to manage healthy wild horses on healthy public rangelands. As wild horse populations continue to increase above appropriate management levels, the BLM is seeking new management tools to help control growth and maintain herd size at a level that the land can support. As part of this effort, the BLM worked with stakeholders and an innovation management firm to design a Prize Competition that would seek new solutions to control herd growth, funded through private contributions and/or sponsorships. BLM intends to launch the Prize Competition if funding for the prize becomes available.

III. Bureau Activities on Prize Competitions under other Authorities

Bureau of Safety and Environmental Enforcement

The Bureau of Safety and Environmental Enforcement (BSEE) launched an initiative to promote STEM education while engaging and raising its profile with the future STEM workforce. The first competition under this initiative was for the best adaptation for offshore use of a piezoelectric technology developed by NASA. [Such technology utilizes piezoelectric materials to generate electrical power using mechanical stress or energy.] The competition, which was offered under its general authority to promote safety, protect the environment, and conserve resources offshore, was jointly sponsored by BSEE and the Ocean Energy Safety Institute (OESI), an institute formed by BSEE through a partnership between the University of Houston, Texas A&M University and the University of Texas at Austin. The competition challenged participants to modify the NASA technology to harness energy generated by underwater soundwaves to power a remote control helicopter, fly it across a stadium and land it on a designated spot (to represent an offshore platform). This competition was conceived to mimic, at a small scale, the trip of a piezoelectric-powered helicopter flying from land to an offshore platform. Teams from various Houston schools participated in the challenge. The top four teams shared cash prizes and their schools received teaching grants. The winning team was featured at the Offshore Technology Conference in May. It is anticipated that the Tech Challenge will be expanded in 2017 beyond Houston to include schools and sites in California and Louisiana.

Fish and Wildlife Service

The U.S. Fish and Wildlife Service (FWS) announced winners of its Ivory Crush Design Challenge, which had solicited proposals for powerful visual concepts for public displays fabricated from crushed ivory from the U.S. ivory crushes. The winners, Kelly Lance of Monterey, Calif., and Jacqueline Nott of Auburn, Calif., should see their ideas on paper transformed into three dimensions as the Service works with partners to build their designs and identify publicly accessible venues with high visibility to display the exhibits.

IV. Specific Prize Competitions

The following pages provide details on each prize competition that was offered or ongoing under the lead sponsorship of a DOI bureau. Appendix A includes details on the following competitions that were new or still open in FY 2016 under the America COMPETES Reauthorization Act of 2010 (15 USC Section 3719).

- Quantifying Drift Invertebrates in River and Estuary Systems. Lead sponsor: Reclamation.
- Downstream Fish Passage at Tall Dams. Lead sponsor: Reclamation.
- Detecting the Movement of Soils (Internal Erosion) Within Earthen Dams, Canals, Levees, and their Foundations. Lead sponsor: Reclamation.
- Preventing Rodent Burrows in Earthen Dam, Canal, and Levee Embankments. Lead sponsor: Reclamation.
- Memorials for the Future. Sponsor: NPS.

Appendix B provides details on prize competitions offered by BSEE and FWS under their general authorities to advance their respective missions:

- High School Offshore and Technology Stars Challenge. Sponsor: BSEE.
- Crushed Ivory Design Challenge Prize. Sponsor: FWS.

Appendix A

New or Open Competitions in FY 2016 under the America COMPETES Reauthorization Act of 2010 (15 USC Section 3719)

- Quantifying Drift Invertebrates in River and Estuary Systems. Lead sponsor: Reclamation.
- Downstream Fish Passage at Tall Dams. Lead sponsor: Reclamation.
- Detecting the Movement of Soils (Internal Erosion) Within Earthen Dams, Canals, Levees, and their Foundations. Lead sponsor: Reclamation.
- Preventing Rodent Burrows in Earthen Dam, Canal, and Levee Embankments. Lead sponsor: Reclamation.
- Memorials for the Future. Sponsor: NPS.

Title	Quantifying Drift Invertebrates in River and Estuary Systems
Sponsoring Agency	Department of the Interior – Bureau of Reclamation
Prize Authority	America COMPETES Reauthorization Act of 2010 (15 USC 3719)
Primary Point of Contact	Connie Svoboda, csvoboda@usbr.gov , 303.445.2152
Link	https://www.challenge.gov/challenge/quantifying-drift-invertebrates-in-river-and-estuary-systems/
Federal Register Notice	October 7, 2015
Submissions Opened	October 7, 2015
Submissions Due	November 16, 2015
Winners Announced	January 29, 2016
Phases	Single phase
Number of Submissions	24
Number of Teams Entered	Unknown. Registration does not distinguish between individual participants and a team.
Number of Participants	23
Number of Individuals Awarded	4
Number of Prizes Awarded	5
Total Prize Purse	\$30,000
Individual Awards	\$12,500 \$5000 \$5000 \$5000 \$2500
Non-Monetary Incentives	None
Operational Costs paid by Agency	Contract Costs: ~ \$36,000 Reclamation Labor Cost ~ \$25,000 (1 Design Co-lead and 2 judges, promotional campaign)
Estimated Value of Partner Contribution	~\$39,000 1 Design Co-Lead 6 Judges
Estimated Investment Made by Solvers	~ \$ 120,000 (~24 x \$5000)

1. Problem Statement

Reclamation wanted to identify devices/methods that can detect, count, and identify zooplankton and drift invertebrates economically in rivers and estuary systems.

Accurate food counts, such as zooplankton and drift invertebrates, are instrumental in fish habitat evaluation and restoration in our rivers and streams. Although technology has been developed for automated detection and identification of zooplankton and drift invertebrates in oceanographic settings, they have not been developed for the unique environmental conditions in rivers and estuaries. High flow rates and turbidity cause problems with automated visual systems used today. The main obstacle in estuaries is turbidity while the main obstacle in river systems is flow velocity. In addition, the horizontal nature of rivers invokes problems not encountered in deep ocean waters (e.g., sunlight effects at the surface of water and the mixing of food sources throughout the water column in rivers due to turbulence as opposed to more stratified food webs in ocean waters).

2. Solution Type: Ideas

3. Proposed Goals

Find better, affordable, and more effective ideas/methods that will help Reclamation, other Federal, state, and local organizations protect and recover threatened and endangered fish species.

4. Goals Type

- a. Build capacity
- b. Engage new people and communities
- c. Solve a specific problem

5. Measures of Success

The prize competition approach enabled us to engage individuals with impressive credentials that work in other technical domains. The ability to solicit solution concepts from the broader public demonstrated the merit of prize competitions to introduce new or improved ideas into the thinking of our subject matter experts, and stimulated our thinking about other ways to make some of these ideas work.

All of the awarded solutions proposed approaches that had not been previously considered by Federal fish recovery subject matter experts. While each solution has novel elements, each will also require additional development and testing before merit can be fully accessed. Regardless the need for additional development and testing is expected for prize competitions seeking new ideas.

6. Results

Reclamation received 24 submissions and awarded monetary prizes to 5 submissions. The rules of the competition grant the Federal government a right to use only the awarded submissions.

The two top-ranked solutions were submitted by Edem Tsikata, Ph.D. Tsikata has a Ph.D. in physics from Harvard University and is currently working as a researcher at Harvard Medical School and Massachusetts Eye and Ear Infirmary. His top ranked solution proposed using commercially available digital holographic imaging equipment with modifications that would enable successful identification and quantification of invertebrates in rivers and estuary environments. This was the only submission meeting all the solution technical requirements stated in the prize competition. A team of federal researchers are now considering approaches to further develop, scale-up and test this concept.

Tsikata's second place solution proposed using high resolution sonar. Although not readily apparent that this solution could meet all the stated technical requirements, it demonstrated sufficient merit for Reclamation to further explore how it can make this concept work. He received \$17,500 for submitting the two ideas.

Other solutions with sufficient merit to be awarded prizes include:

- Matt Vaillancourt submitted a design for an examination chamber where water could be collected and processed with the capability to electronically identify and quantify the various drift invertebrates in the water. A \$5,000 prize has been awarded to secure a license that will allow the federal government to further develop, test and use this concept. Vaillancourt has a degree in mechanical engineering from California Polytechnic State University with an emphasis in mechatronics and is now working on projects that integrate complimentary technologies such as microcomputers, motion control, and 3D modeling.
- Ted Ground submitted a design for a continuous sampling device that uses air bubbles to lift and concentrate invertebrates at the water surface where imaging and cataloging could occur with an array of cameras. Mr. Ground has also received a \$5,000 prize to secure a license that will allow the federal government to further develop, test and use this concept. Ground has a Master of Science degree in Aquatic Biology from Texas State University and is currently an independent technical consultant working on a wide variety of aquaculture, water quality and natural resources related projects.
- Michael May, Ph.D., proposed using an array of lensless cameras to search a volume of water backlit by a commercial flat-panel display. Lensless camera technology is low cost and has an infinite depth of focus. The federal government also secured a license to further develop, test and use this concept by awarding May a \$2,500 prize. May earned his Ph.D. in physics from Johns Hopkins University and is currently the president of the technology and strategy consulting firm Dana Point Analytics.

7. Participation Requirements

ELIGIBILITY RULES: To be able to win a prize under this competition, an individual or entity must:

1. Agree to the rules of the competition (15 U.S. Code § 3719(g)(1));
2. Be an entity that is incorporated in and maintains a primary place of business in the United States, or (b) in the case of an individual, a citizen or permanent resident of the United

States (15 U.S. Code § 3719(g)(3));

3. Not be a Federal entity or Federal employee acting within the scope of their employment; (15 U.S. Code § 3719(g)(4));

4. Assume risks and waive claims against the Federal Government and its related entities (15 U.S. Code § 3719(i)(1)(B)); and,

5. Not use Federal facilities, or consult with Federal employees during the competition unless the facilities and employees are made available to all individuals and entities participating in the competition on an equitable basis.

The following individuals or entities are not eligible regardless of whether they meet the criteria set forth above:

1. Any individual who employs an evaluator on the Judging Panel or otherwise has a material business relationship or affiliation with any Judge.

2. Any individual who is a member of any Judge's immediate family or household.

3. The Seeker, participating organizations, and any advertising agency, contractor or other individual or organization involved with the design, production, promotion, execution, or distribution of the prize competition; all employees, representatives and agents thereof; and all members of the immediate family or household of any such individual, employee, representative, or agent.

4. Any individual or entity that uses Federal funds to develop the proposed solution now or any time in the past, unless such use is consistent with the grant award, or other applicable Federal funds awarding document. NOTE: Submissions that propose to improve or adapt existing federally funded technologies for the solution sought in this prize competition are eligible.

8. Incentives

Total Cash Prize: \$30,000

Source: Funds appropriated to the Bureau of Reclamation Science and Technology Program specific for prize competitions.

9. Evaluation and Judging

Winning submission recommendations are made to Reclamation's Science Advisor by a judging panel. Reclamation's Science Advisor is Reclamation's delegated official with the authority to implement prize competitions under 15 USC 3719.

Submissions required solvers to submit a theoretical paper explaining why their proposed solution could meet stated technical performance specifications. Submissions were evaluated by a judging panel composed of scientists, engineers, and other related technical experts.

Solutions that meet the technical requirements were also be judged on the following items in order of priority:

- Practical feasibility
- Detection precision
- Manufacturing cost
- Required power source
- Extra weight / space

- Time to market

10. Partnerships

The NOAA-National Marine Fisheries Service, U.S. Geological Survey, U.S. Fish and Wildlife Service, and U.S. Army Corps of Engineers provided prize competition design and judging assistance

11. Resources

Reclamation used the contracting services of InnoCentive to help design and administer this competition, and to distribute the challenge to the InnoCentive curated solver community.

Reclamation funded InnoCentive and Reclamation staff and a portion of the USGS assistance. All other agencies funded their own contributed collaboration.

Title	Downstream Fish Passage at Tall Dams
Sponsoring Agency	Department of the Interior – Bureau of Reclamation
Prize Authority	America COMPETES Reauthorization Act of 2010 (15 USC 3719)
Primary Point of Contact	Connie Svoboda, csvoboda@usbr.gov , 303.445.2152
Link	https://www.challenge.gov/challenge/downstream-fish-passage-at-tall-dams/
Federal Register Notice	March 31, 2016
Submissions Opened	March 31, 2016
Submissions Due	May 10, 2016
Winners Announced	July 29, 2016
Phases	Single phase
Number of Submissions	44
Number of Teams Entered	Unknown. Registration does not distinguish between individual participants and a team.
Number of Participants	44
Number of Individuals Awarded	4
Number of Prizes Awarded	4
Total Prize Purse	\$20,000
Individual Awards	\$10,000 \$4,000 \$3,500 \$2,500
Non-Monetary Incentives	None
Operational Costs paid by Agency	Contract Costs: ~ \$16,000 Reclamation Labor Cost ~ \$42,000 (1 Design Co-lead, 3 judges, 3 technical reviewers, promotion campaign)
Estimated Value of Partner Contribution	~\$30,000 1 Design Co-Lead 5 Judges
Estimated Investment Made by Solvers	~ \$220,000 (~44 x \$5000)

1. Problem Statement

Is there a better way to pass downstream-moving juvenile fish over or around tall (i.e. high-head) dams?

While downstream passage over high-head dams for some species and life history stages has been achieved to a limited degree, much improvement in downstream juvenile fish passage is still needed. Effective downstream passage, paired with effective upstream passage, would increase habitat availability that many threatened and endangered fish populations need to rebuild resilient populations. New ideas for gaining successful and cost-effective downstream passage of juvenile fish at tall dams are being sought by this Challenge.

2. Solution Type: Ideas

3. Proposed Goals

Find better, affordable, and more effective ideas/methods that will help Reclamation, other Federal, state, and local organizations protect and recover threatened and endangered fish species.

4. Goals Type
 - a. Build capacity
 - b. Engage new people and communities
 - c. Solve a specific problem

5. Measures of Success

The prize competition approach enabled us to engage individuals with impressive credentials that work in other technical domains. The ability to solicit solution concepts from the broader public demonstrated the merit of prize competitions to introduce new or improved ideas into the thinking of our subject matter experts, and stimulated our thinking about other ways to make some of these ideas work.

Some of the awarded solutions proposed variations or improvements to existing methods, while other awarded approaches had not been previously considered or known by Federal fish recovery subject matter experts. While each solution had novel elements, they will also require additional development and testing before merit can be fully accessed. The need for additional development and testing is expected for prize competitions seeking new ideas.

The prize competition generated very favorable press coverage in Northern California where salmon passage pas dams is a major problem. As such, the prize competition successfully demonstrated to the public and stakeholders that Reclamation and federal and state collaborators are trying everything to find new or better solutions to this difficult problem.

6. Results

Reclamation received 44 submissions and awarded monetary prizes to 4 submissions. The rules of the competition provided the Federal Government with a license to use all 44 ideas and allow others to do so.

\$10,000 Award: The top submission is a system that utilizes a drag conveyor system, similar to the systems used to transport delicate solids, to pass fish downstream. A person that worked as food manufacturing process engineer proposed this solution. The system could manage pressure within the chambers, minimizing barotrauma. This concept should be investigated further to see if the pipe diameter could be scaled up and to see the applications for which it is being used currently. The other concepts presented for attraction and discharge are similar to existing methods used. The team agreed that this was the top submission.

\$4,000 Award: The use of an Archimedean internal helical “de-elevator” device to move small fish downstream past high head dams is novel and worth further investigation. There may be difficulty in scaling this concept to the size needed to move the anticipated volume of water. Also the ability to attract fish to the entrance of the bypass remains unresolved based on this submission.

\$3,500 Award: The solution uses nets to guide fish to multiple extractions points, and flexible pipe attached to buoy to convey fish through the dam abutment to the river downstream in atmospheric pressure conditions. This is a simple solution with not many moving parts, which provides a volitional method to convey fish downstream in atmospheric pressure conditions.

\$2,500 Award: This proposal described innovative ways of attracting fish to a collection location, particularly the use of cover, and protecting them from predators at that location. The use of cover to congregate fish at a collection location has not, to Reclamation’s knowledge, been used in a fish passage situation. It may have merit in the future.

Although we found a few new ideas that have some merit for parts of the problem, the prize competition results also demonstrated that the current, collective efforts of Reclamation and other federal and state collaborators largely represents best known practices.

7. Participation Requirements

ELIGIBILITY RULES: To be able to win a prize under this competition, an individual or entity must:

1. Agree to the rules of the competition (15 U.S. Code § 3719(g)(1));
2. Be an entity that is incorporated in and maintains a primary place of business in the United States, or (b) in the case of an individual, a citizen or permanent resident of the United States (15 U.S. Code § 3719(g)(3));
3. Not be a Federal entity or Federal employee acting within the scope of their employment; (15 U.S. Code § 3719(g)(4));
4. Assume risks and waive claims against the Federal Government and its related entities (15 U.S. Code § 3719(i)(1)(B)); and,

5. Not use Federal facilities, or consult with Federal employees during the competition unless the facilities and employees are made available to all individuals and entities participating in the competition on an equitable basis.

The following individuals or entities are not eligible regardless of whether they meet the criteria set forth above:

1. Any individual who employs an evaluator on the Judging Panel or otherwise has a material business relationship or affiliation with any Judge.
2. Any individual who is a member of any Judge's immediate family or household.
3. The Seeker, participating organizations, and any advertising agency, contractor or other individual or organization involved with the design, production, promotion, execution, or distribution of the prize competition; all employees, representatives and agents thereof; and all members of the immediate family or household of any such individual, employee, representative, or agent.
4. Any individual or entity that uses Federal funds to develop the proposed solution now or any time in the past, unless such use is consistent with the grant award, or other applicable Federal funds awarding document. NOTE: Submissions that propose to improve or adapt existing federally funded technologies for the solution sought in this prize competition are eligible.

8. Incentives

Total Cash Prize: \$20,000

Source: Funds appropriated to the Bureau of Reclamation Science and Technology Program specific for prize competitions.

9. Evaluation and Judging

Winning submission recommendations are made to Reclamation's Science Advisor by a judging panel. Reclamation's Science Advisor is Reclamation's delegated official with the authority to implement prize competitions under 15 USC 3719.

Submissions required solvers to submit a theoretical paper explaining why their proposed solution could meet stated technical performance specifications. Submissions were evaluated by a judging panel composed of scientists, engineers, and other related technical experts. Solutions that met the requirements were judged on the following items in order of priority:

- Feasibility
- Flexibility to changing conditions (water level, temperature, debris)
- Overall costs
- Scalability

10. Partnerships

U.S. Geological Survey, NOAA-National Marine Fisheries Service, U.S. Army Corps of Engineers, and the State of California provided prize competition design and judging assistance.

11. Resources

Reclamation used the contracting services of InnoCentive to help design and administer this competition, and to distribute the challenge to the InnoCentive curated solver community.

Reclamation funded InnoCentive and Reclamation staff and a portion of the USGS assistance. All other agencies/organizations funded their own contributed collaboration.

Title	Detecting the Movement of Soils (Internal Erosion) Within Earthen Dams, Canals, Levees, and their Foundations
Sponsoring Agency	Department of the Interior – Bureau of Reclamation
Prize Authority	America COMPETES Reauthorization Act of 2010 (15 USC 3719)
Primary Point of Contact	Dr. Bobbi Jo Merten, (303) 445-2380, bmerten@usbr.gov
Link	https://www.challenge.gov/challenge/preventing-rodent-burrows-in-earthen-embankments/
Federal Register Notice	March 31, 2016
Submissions Opened	March 31, 2016
Submissions Due	May 10, 2016
Winners Announced	July 29, 2016
Phases	Single phase
Number of Submissions	29
Number of Teams Entered	Unknown. Registration does not distinguish between individual participants and a team.
Number of Participants	29
Number of Individuals Awarded	5
Number of Prizes Awarded	5
Total Prize Purse	\$20,000
Individual Awards	\$6,250 \$6,250 \$2,500 \$2,500 \$2,500
Non-Monetary Incentives	None
Operational Costs paid by Agency	Contract Costs: ~ \$16,000 Reclamation Labor Cost ~ \$50,000 (1 Design Co-lead, 1 designer, 5 judges, promotional campaign)
Estimated Value of Partner Contribution	~\$39,000 (1 Design Co-Lead, 2 technical reviewers 4 Judges)
Estimated Investment Made by Solvers	~ \$145,000 (~29 x \$5000)

1. Problem Statement:

Are there better methods for detecting directly the movement (erosion) of soils in earthen structures and foundations, or detecting indirect indicators of soil movement as internal erosion initiates or is in the early stages of propagation? The goal is to detect soil movement earlier than it is normally detected by current visual inspection and instrumentation methods.

The Bureau of Reclamation, U.S. Army Corp of Engineers, and State agencies, inspect, and assess the condition and performance of dams and other earthen embankments. While inspection and condition assessment programs are effective ways to protect the public and property, these current methods are resource intensive and cannot reliably detect internal erosion early in the process. Internal erosion can take place over a long period of time, but often remains invisible (inside or below the structure) until serious damage occurs. This places lives, property, and critical water supply or flood retention capabilities at risk. The ability to reliably detect internal erosion early in the process would help Reclamation, USACE, and all dam, levee, and canal owners to reduce risks by encouraging early-intervention.

2. Solution Type: Ideas

3. Proposed Goals

Find better, affordable, and more effective ideas/methods that will help Reclamation, other Federal, state, and local organizations improve the safety and reliability of earthen embankments designed to store and convey water.

4. Goals Type
 - a. Build capacity
 - b. Engage new people and communities
 - c. Solve a specific problem

5. Measures of Success

The ability to solicit solution concepts from the broader public demonstrated the merit of prize competitions to introduce new or improved ideas into the thinking of our subject matter experts, and stimulated our thinking about other ways to make some of these ideas work.

Some of the awarded solutions proposed variations or improvements to existing methods, while other awarded approaches had not been previously considered or known by the panel of expert judges. While each solution had novel elements, each will also require additional development and testing before merit can be fully accessed. But the need for additional development and testing is expected for prize competitions seeking new ideas.

6. Results

Reclamation received 29 submissions and awarded monetary prizes to 5 submissions. The rules of the competition provided the Federal Government with a license to use all 29 ideas and allow others to do so. A synopsis of the winning solutions is provided below:

\$6,250 Award: Phased array seismic tomographic anomaly imaging

\$6,250 Award: Superconducting quantum interference device

\$2,500 Award: Robot enabled underwater flowmeter

\$2,500 Award: Brine seepage tracer

\$2,500 Award: Shear-wave reflection seismic imaging

The phased array seismic tomographic anomaly solution is the most solid and well-presented solution relative to the prize competition criteria. The approach uses existing technologies. However, Reclamation is unaware of any prior applications of this technology by the dam safety and engineering community. The submission reinforces and strengthens the concepts considered to be technically viable by the judging team. Implementation introduces cost, maintenance, and vandalism concerns, which require further consideration, but it is the most implementation-ready solution.

The superconducting quantum interference device has a high probability for implementation as an indirect method to detect internal erosion. It is believed that the proposed solution could feasibly detect new concentrated seepage pathways prior to initiation of internal erosion. It proposes using existing technology in a novel way/application that is untested for effectiveness in detecting concentrated seepage and/or the movement of soils in embankment structures. It is theoretically sound and does not require permanent installation on an embankment. Additional research and testing is needed to evaluate its capabilities and reliability. Equipment cost could be a limiting factor, but costs are expected to be lower in the near-future.

Two additional solutions included noteworthy components that may be worth carrying forward even though they did not qualify for an award. These are an infra-red thermography and statistical analysis of sinkholes (as a basis for remote sensing detection). Both may be interesting topics to explore further. Judges discussed the citizen science component offered by another solution which would allow visitors to an embankment to formalize their observations by submitting text and photographs to a website or a database. Often, indications of internal erosion are noticed by visual inspection.

7. Participation Requirements

ELIGIBILITY RULES: To be able to win a prize under this competition, an individual or entity must:

1. Agree to the rules of the competition (15 U.S. Code § 3719(g)(1));
2. Be an entity that is incorporated in and maintains a primary place of business in the United States, or (b) in the case of an individual, a citizen or permanent resident of the United States (15 U.S. Code § 3719(g)(3));
3. Not be a Federal entity or Federal employee acting within the scope of their employment; (15 U.S. Code § 3719(g)(4));

4. Assume risks and waive claims against the Federal Government and its related entities (15 U.S. Code § 3719(i)(1)(B)); and,

5. Not use Federal facilities, or consult with Federal employees during the competition unless the facilities and employees are made available to all individuals and entities participating in the competition on an equitable basis.

The following individuals or entities are not eligible regardless of whether they meet the criteria set forth above:

1. Any individual who employs an evaluator on the Judging Panel or otherwise has a material business relationship or affiliation with any Judge.

2. Any individual who is a member of any Judge's immediate family or household.

3. The Seeker, participating organizations, and any advertising agency, contractor or other individual or organization involved with the design, production, promotion, execution, or distribution of the prize competition; all employees, representatives and agents thereof; and all members of the immediate family or household of any such individual, employee, representative, or agent.

4. Any individual or entity that uses Federal funds to develop the proposed solution now or any time in the past, unless such use is consistent with the grant award, or other applicable Federal funds awarding document. NOTE: Submissions that propose to improve or adapt existing federally funded technologies for the solution sought in this prize competition are eligible.

8. Incentives

Total Cash Prize: \$20,000

Source: Funds appropriated to the Bureau of Reclamation Science and Technology Program specific for prize competitions.

9. Evaluation and Judging

Winning submission recommendations were made to Reclamation's Science Advisor by a judging panel. Reclamation's Science Advisor is Reclamation's delegated official with the authority to implement prize competitions under 15 USC 3719.

Submissions required solvers to submit a concept paper explaining why their proposed solution could meet stated technical performance specifications. Submissions were evaluated by a judging panel composed of scientists, engineers, and other related technical experts. Solutions that met the requirements were also judged on the following items in order of priority:

- Adaptability
- Scalability
- Readiness
- Originality

10. Partnerships

U.S. Army Corps of Engineers, and the State of Colorado provided prize competition design and judging assistance.

11. Resources

Reclamation used the contracting services of InnoCentive to help design and administer this competition, and to distribute the challenge to the InnoCentive curated solver community.

Reclamation funded InnoCentive and Reclamation staff. All other agencies/organizations funded their own contributed collaboration.

Title	Preventing Rodent Burrows in Earthen Embankments
Sponsoring Agency	Department of the Interior – Bureau of Reclamation
Prize Authority	America COMPETES Reauthorization Act of 2010 (15 USC 3719)
Primary Point of Contact	Dr. Jessica Torrey, (303) 445-2376, jtorrey@usbr.gov.
Link	https://www.challenge.gov/challenge/preventing-rodent-burrows-in-earthen-embankments/
Federal Register Notice	August 29, 2016
Submissions Opened	August 29, 2016
Submissions Due	October 11, 2016
Winners Announced	December 27, 2016
Phases	Single phase
Number of Submissions	75
Number of Teams Entered	Unknown. Registration does not distinguish between individual participants and a team.
Number of Participants	75
Number of Individuals Awarded	5
Number of Prizes Awarded	5
Total Prize Purse	\$20,000
Individual Awards	\$5,500 \$5,500 \$4,000 \$2,500 \$2,500
Non-Monetary Incentives	None
Operational Costs paid by Agency	Contract Costs: ~ \$16,000 Reclamation Labor Cost ~ \$60,000 (2 Design Co-leads, and 7 judge, promotion campaign)
Estimated Value of Partner Contribution	~\$40,000 (5 technical reviewers 5 Judges)
Estimated Investment Made by Solvers	~ \$375,000 (~75 x \$5000)

1. Problem Statement:

Is there a way to stop and prevent rodents from burrowing into earthen embankments of dams, canals, and levees?

Rodent burrows can fill with water when the water levels change, creating seepage paths that can lead to internal erosion in embankments and result in the potential for catastrophic failure. Embankment failures can cause property damage, cause loss of life, and interrupt crucial deliveries of water in the West and across the nation.

Trapping or baiting rodents on earthen embankments are short term remedies, and experience has shown that within a short time, the rodents inevitably return. Annual programs of rodent removal over thousands of miles of earthen embankment are cost prohibitive and only marginally successful. Solvers are asked for creative, cost effective, long-term solutions to this very real and serious problem.

2. Solution Type: Ideas

3. Proposed Goals

- a. Reduce by 95% the ability of rodents to burrow in the embankments.
- b. Be able to be applied at discrete, remote locations where power is not available.
- c. Work reliably for a minimum of 5 years without interruption or major repairs.
- d. Requires maintenance labor activities no more than every 6 months.
- e. Be cost effective to treat or cover earthen embankments that are 1 mile long, but be scalable to treat embankments that are 50 miles long.

4. Goals Type

- a. Build capacity
- b. Engage new people and communities
- c. Solve a specific problem

5. Measures of Success

The ability to solicit solution concepts from the broader public demonstrated the merit of prize competitions to introduce new or improved ideas into the thinking of our subject matter experts, and stimulated our thinking about other ways to make some of these ideas work.

Some of the awarded solutions proposed variations or improvements to existing methods, while other awarded approaches had not been previously considered or known by the panel of expert judges. While each solution had novel elements, each will also require additional development and testing before merit can be fully accessed. But the need for additional development and testing is expected for prize competitions seeking new ideas.

6. Results

Reclamation received 75 submissions and awarded monetary prizes to 5 submissions. The rules of the competition provided the Federal Government with a license to use all 75 ideas and allow others to do so. A synopsis of the winning solutions is provided below:

\$5,500 Award: Subsurface cut-off wall barrier using hydro-excavation

\$5,500 Award: Surface geotextile with embedded steel wool

\$4,000 Award: Combination of predators and hydro-seeded plant deterrents

\$2,500 Award: Simple machine for subsurface acoustic deterrent

\$2,500 Award: Robotic smart trap

The subsurface cut-off wall barrier using hydro-excavation is a solid and well-presented solution relative to the prize competition criteria. The approach uses existing cut off wall applications. However, Reclamation is not aware of any prior uses of hydro-excavation applications to create narrower trenches in embankments. The submission reinforces and strengthens the concepts considered to be technically viable by the judging team. Implementation description addresses the technical requirements and is one of the most implementation-ready solutions.

The surface geotextile with embedded steel wool is a solid solution that is likely to have a high initial cost but likely to be a very effective and cost-effective long-term solution. The solution is a surface treatment that still allows vegetation to become established on the embankment for erosion control and would allow visual observation of the embankment for inspection purposes. Further investigation is needed to determine actual costs and long-term effectiveness.

The combination of predators and hydro-seeded plant deterrents solution is considered to be a viable combination solution that is inexpensive, easy to install, and requires little overall maintenance. This proposal incorporates certain agricultural techniques in combination with native wildlife predator management, such as owls, to ensure effective rodent control in water embankment areas with minimal intrusion to the ecosystem. Because it requires growth of particular vegetation, it may not be suitable for all climates; however, with the combination of predator management and vegetation establishment, it could be adapted to many, if not most climates. Further investigation is needed to evaluate the appropriate combinations of vegetation and predator establishment for different climates and regions. If suitable habitat can be established for threatened and endangered birds of prey, such a solution might also assist with the recovery of threatened and endangered species in certain areas.

The simple machine for subsurface acoustic deterrent is activated by wind and has the potential to be inexpensive, easy to install, and low-maintenance. There were many proposed solutions using acoustics and this one stood out to the judges because of the simple method to develop random acoustics without a power source. Random acoustic emissions are not as susceptible to rodent habituation, which is a weakness of acoustic methods. Further investigation is needed to determine the effectiveness of this random acoustic method and the transmission distance.

The robotic smart trap is the most innovative solution. This solution provided an outside-the-box idea that addressed all of the technical requirements, but requires further investigation and development of the ability to avoid non-target species. Although addressed by the solver, additional innovation of the robot is necessary to ensure the movement of the robot on steep

embankment slopes, refining the design to limit O&M costs of the robot, and ability of the trap to attract rodents.

7. Participation Requirements

ELIGIBILITY RULES: To be able to win a prize under this competition, an individual or entity must:

1. Agree to the rules of the competition (15 U.S.C. 3719(g)(1));
2. Be an entity that is incorporated in and maintains a primary place of business in the United States, or (b) in the case of an individual, a citizen or permanent resident of the United States (15 U.S.C. 3719(g)(3));
3. Not be a Federal entity or Federal employee acting within the scope of their employment; (15 U.S.C. 3719(g)(4));
4. Assume risks and waive claims against the Federal Government and its related entities (15 U.S.C. 3719(i)(1)(B)); and,
5. Not use Federal facilities, or consult with Federal employees during the competition unless the facilities and employees are made available to all individuals and entities participating in the competition on an equitable basis.

The following individuals or entities are not eligible regardless of whether they meet the criteria set forth above:

1. Any individual who employs an evaluator on the Judging Panel or otherwise has a material business relationship or affiliation with any Judge.
2. Any individual who is a member of any Judge's immediate family or household.
3. The Seeker, participating organizations, and any advertising agency, contractor or other individual or organization involved with the design, production, promotion, execution, or distribution of the prize competition; all employees, representatives and agents thereof; and all members of the immediate family or household of any such individual, employee, representative, or agent.
4. Any individual or entity that uses Federal funds to develop the proposed solution now or any time in the past, unless such use is consistent with the grant award, or other applicable Federal funds awarding document. NOTE: Submissions that propose to improve or adapt existing federally funded technologies for the solution sought in this prize competition are eligible.

8. Incentives

Total Cash Prize: \$20,000

Source: Funds appropriated to the Bureau of Reclamation Science and Technology Program specific for prize competitions.

9. Evaluation and Judging

Winning submission recommendations are made to Reclamation's Science Advisor by a judging panel. Reclamation's Science Advisor is Reclamation's delegated official with the authority to implement prize competitions under 15 USC 3719.

Submissions required solvers to submit a concept paper explaining why their proposed solution could meet stated technical performance specifications. Submissions were evaluated by a judging panel composed of scientists, engineers, and other related technical experts. Solutions that met the requirements were also judged on the logistical feasibility, applicability to varying environments, readiness, overall costs, and scalability.

10. Partnerships

The U.S. Army Corps of Engineers, the State of Colorado Department of Natural Resources and with federal canal operating entities including the Boise Project Board of Control and the South Columbia Basin Irrigation District provided prize competition design and judging assistance.

11. Resources

Reclamation used the contracting services of InnoCentive to help design and administer this competition, and to distribute the challenge to the InnoCentive curated solver community.

Reclamation funded InnoCentive and Reclamation staff. All other agencies/organizations funded their own contributed collaboration.

Title	Memorials for the Future
Sponsoring Agency	National Park Service
Prize Authority	America COMPETES Reauthorization Act of 2010 (15 USC 3719)
Primary Point of Contact	Tammy Stidham, tammy_stidham@nps.gov , 202-619-7474
Link	Future.ncpc.gov
Submissions Opened	April 11, 2016
Submissions Due	Semi-finalists May 4, 2016; Finalists August 8, 2016
Winners Announced	September 8, 2016
Phases	<ul style="list-style-type: none"> • May 4, 2016 – Semi-finalist Concept Submission Deadline • June 8, 2016 – Top Four Finalists Announced • June 8, 2016 – Finalists Begin Development of Proposals • July 8, 2016 – Design Framework Working Session • August 3, 2016 – Final Presentation • August 8, 2016 – Final Deliverables Due • September 8, 2016 – Announcement of Competition Winner and Exhibition Launch
Number of Submissions	>300
Number of Teams Entered	90
Number of Participants	Not available (NA)
Number of Individuals Awarded	14
Number of Prizes Awarded	4 = 1 winner + 3 honorable mentions
Total Prize Purse	\$60,000
Individual Awards	\$15,000 per each winner/honorable mention
Non-Monetary Incentives	Finalists' design concepts exhibited publicly in the Hall of Nations at the John F. Kennedy Center for the Performing Arts, September 8 through October 20, 2016
Operational Costs paid by Agency	\$124,233.05
Estimated Value of Partner Contribution	\$65,000
Estimated Investment Made by Solvers	NA

1. Problem Statement:

Memorials for the Future called for designers, artists, and social scientists to develop new inclusive and flexible ways to commemorate people and events. These memorials should enrich Washington's landscape while responding to the limitations of traditional commemoration. As the NPS celebrated its centennial in 2016, *Memorials for the Future* created new ideas for honoring our diverse histories, heritage, and culture.

Memorials enshrine what a society wants to remember, but the places, people, and stories that it memorializes, and the audiences that engage with them, are in fact constantly changing. A memorial tells its story through subject matter and design. This story is often complex and multi-dimensional as a memorial's interpretive elements embody ideas of identity, culture, and heritage, and each have intensely personal interpretations for every individual.

As the national capital, Washington is a focal point for commemorations of the nation's collective memory. Monuments sited throughout the city take on heightened significance as they reflect relationships among nations, of national remembrance, and of many important events and figures in our history. Often the traditional and fixed nature of memorial designs do not allow for adaptation and redefinition over time, or encourage more than one interpretation of a given narrative.

Memorials for the Future was a conscious effort to look beyond the traditional approach to developing memorials in Washington, which has resulted in a commemorative landscape that is thematically similar and increasingly land-intensive, poses challenges for Washington's urban park system and has long-term implications for the potential uses of a memorial's surrounding park setting.

2. Solution Type: Ideas

3. Proposed Goals

The goals of the competition were to create new approaches to and forms of memorializing that would:

- Advance a framework for the planning and design of commemorative works in the 21st century.
- Demonstrate how temporary, mobile, interactive or adaptive displays can provide powerful and memorable experiences that are cost-efficient.
- Develop ways to commemorate that are inclusive of multiple narratives and have the potential to be flexible as perspectives change.
- Honor the scale, context and national significance of Washington, DC.

4. Goals Type

Solve a growing problem of commemorating significant historical, cultural and other events even as society changes and space for memorials diminishes.

5. Measures of Success

Proposals presented:

- Exciting possibilities for future memorials.
- New ways to engage diverse new subject matter
- Ways for reinterpretation over time
- Ways to enable and respect multiple narratives
- Considerations of technology
- Ways to honor national contexts and local experiences.
- Designs that can adapt and evolve, are sometimes ephemeral or temporary, and often engage the public directly as part of the memorial

All of these will be used as lessons learned and provided to memorial sponsors as examples of ways to commemorate that do not require granite and stone.

6. Results

As part of the event announcing the four finalists, NPS hosted a panel discussion at the National Archives on June 8, 2016. The panel, moderated by Jason Schupbach, Director of Design Programs, and National Endowment for the Arts, examined new approaches for commemoration. The full panel discussion is available at: <https://www.youtube.com/watch?v=FemGqG6mcw8>; or view the highlights at: <https://www.youtube.com/watch?v=uVtYz3l bj-4>.

The winning concept, Climate Chronograph, is a forward-looking memorial that takes a complex global process—climate change—and turns it into a personal experience. While memorials conventionally commemorate a moment in the past, this initially traditional-looking memorial offers a reimagined landscape and a living observatory that allows people to interact with the space as it evolves unpredictably over time.



Figure 1, Climate Chronograph, Photo by Azimuth Land Craft.

A free public exhibition showcasing the winner and finalists' design concepts opened September 8, 2016, in the Hall of Nations at the John F. Kennedy Center for the Performing Arts and ran through October 20, 2016.



Figure 2 Exhibit at the Kennedy Center, Photo by NPS

A video documents the competition and its key findings. It is available at <https://www.youtube.com/watch?v=y28fBhj0mKU/>

7. Participation Requirements

The agency hoped to mobilize designers, artists, and social scientists to develop new ways to commemorate people and events.

8. Incentives

Total Cash Prize: \$60,000

The submissions were offered recognition, rather than a cash prize or monetary incentive. The four finalists each received a \$15,000 stipend to participate in a research and design process. Teams were required to convene in Washington, DC, four times so each team was offered a reimbursement stipend of up to \$5,200 for flights, hotel, and ground transportation.

9. Evaluation and Judging

Jurors, drawn from experts in the art, history, and architecture communities and among the project partners, helped select finalist teams and winning teams. They also provided feedback during the design framework working session and the final presentation.

Evaluation criteria included:

- Responsiveness to the goals of the competition.
- Overall strength and quality in approach to developing initial concept, design, and narrative.
- Multidisciplinary nature of team members and partners.
- Experience working on research and design projects that incorporate understanding of local context and narratives.
- Experience engaging diverse public audiences.
- Clear communication of a process to relate conceptual narratives to a general audience.
- Commemoration subject is a recognizable part of the American story, reflective of our heritage, history, and culture.
- Clear communication of a process to engage the surrounding community with the proposed concept design.
- Location selected (locations NOT on the National Mall were given preference).

10. Partnerships

NPS partnered with National Capital Planning Commission and the Van Alen Institute. Van Alen Institute assisted with outreach and managed the competition.

11. Resources

Appropriations to NPS and National Capital Planning Commission funded the prize competition. Agency staff was involved in the design and conduct of the competition. Prize competition contracting services from Van Alen provided prize competition design, outreach, and administration services. National Capital Planning Commission provided all the staff and resources required for the production of the competition website, videos, and photography, as well as, for the panel discussion.

Appendix B

Competitions under Authorities other than the America COMPETES Reauthorization *Act* of 2010

Title	High School Offshore and Technology Stars Challenge
Sponsoring Agency	Bureau of Safety and Environmental Enforcement
Prize Authority	General authority to advance bureau mission
Primary Point of Contact	Eileen Angelico (eileen.angelico@bsee.gov , 202-208-7746)
Link	https://www.bsee.gov/site-page/tech-challenge
Submissions Opened	
Submissions Due	
Winners Announced	March 4, 2016
Phases	<ul style="list-style-type: none"> • Team selection: October 9, 2015 • Develop project groups: November 15, 2015 • Research phase: December 18, 2015 • Concept development: January 15, 2016 • Design phase: February 5, 2016 • Test phase: February 24, 2016 • Manufacturing phase: March 4, 2016 • Simulation & final report: March 4, 2016
Number of Submissions	
Number of Teams Entered	
Number of Participants	About 120
Number of Individuals Awarded	
Number of Prizes Awarded	3 prizes for teams + 3 for educators
Total Prize Purse	\$10,250
Individual Awards	<p><u>Team awards:</u> First Place: \$5k US savings bond/or cash prize Second Place: \$2.5k US savings bond/or cash prize Third Place: \$1k US savings bond/or cash prize</p> <p><u>Educator awards</u> First Place: \$1,000 Teaching Grant Second Place: \$500 Teaching Grant Third Place: \$250 Teaching Grant</p>
Non-Monetary Incentives	Expenses paid trips for all team members and educators of top three teams
Operational Costs paid by Agency	

Estimated Value of Partner Contribution	
Estimated Investment Made by Solvers	NA

1. Problem Statement:

Investigate and adapt NASA science technologies from the Johnson Space Center to develop an innovative concept that would apply an aerospace-proven technology to a current challenge within the oil & gas deep water offshore operations industry.

- Develop a relevant technology concept applicable in Gulf of Mexico and/or Arctic environments and provide proof of concept that it would increase safety for deep-water offshore oil & gas industry operations using various relevant design scenarios.
- Construct a working model demonstrating your design/product concept and application.

2. Solution Type: Ideas; model construction

3. Proposed Goals

- Increase the awareness of students and educators involved in science, technology, engineering and math disciplines (STEM) about employment and educational opportunities in the natural resources sector, particularly within BSEE.
- Develop a pipeline to employment opportunities for STEM candidates through increased science literacy and greater engagement of youth with the Nation's natural resources sector, specifically exposure to offshore oil and gas programs.
- Enhance awareness and knowledge of educators to issues related to safety in offshore oil and gas facilities.

4. Goals Type

- Help build future capacity of a highly trained technical workforce within BSEE.
- Engage STEM students in natural resource management.

5. Measures of Success

- Broad participation by high school students in the competition.
- Development and construction of working models based on application of STEM disciplines.

6. Results

The competition challenged participants to modify a NASA technology to harness energy generated by underwater soundwaves to power a remote control helicopter, fly it across a stadium and land it on a designated spot (to represent an offshore platform). This competition was conceived to simulate, at a small scale, the trip of a piezoelectric-powered helicopter flying from land to an offshore platform. Teams from various Houston schools participated in the

challenge. The top teams – including Energy Institute High School, Milby High School, Southwest High School, Westside High School and Young Women’s Preparatory Academy – shared cash prizes, and their schools received teaching grants. The winning team — “The Underdogs” from Westside High School — was featured at the Offshore Technology Conference in May.

7. Participation Requirements

High school students in the Houston area were eligible to participate.

8. Incentives

- A share of the total cash prize (\$10,250) plus expense paid trips of team members and educators.
- Challenge winner was featured at the 2016 OTC after competition was completed.
- All participants received recognition.

The competition was funded through appropriations to the Bureau of Reclamation Science and Technology Program specific for prize competitions.

9. Evaluation and Judging

Projects were graded by a team of educators/senior students and the finalists were invited to compete to decide the winner. The first phase of the competition captured the building of piezoelectric circuit buildup and the charging of the helicopter battery. This electrical portion of the competition was the defining feature of the duration of flight.

10. Partnerships

The Bureau of Safety and Environmental Enforcement received support for this effort from the Ocean Energy Safety Institute (OESI). OESI led the project management team for the tech challenge and worked with the Independent Petroleum Association of America (IPAA) when interacting with the high schools. Additional support was provided by the Petroleum Equipment and Services Association (PESA) and the University of Houston.

Title	Crushed Ivory Design Challenge
Sponsoring Agency	U.S. Fish and Wildlife Service
Prize Authority	General authority to advance bureau mission
Primary Points of Contact	Gavin Shire, Gavin_Shire@fws.gov , 703-358-2649 Danielle Kessler, Danielle_Kessler@fws.gov , 703-358-2644
Link	http://www.fws.gov/international/ivory-challenge.html
Submissions Opened	September 15, 2014
Submissions Due	March 31, 2015
Winners Announced	May 9, 2016
Phases	See above
Number of Submissions	44
Number of Teams Entered	NA
Number of Participants	NA
Number of Individuals Awarded	2
Number of Prizes Awarded	2
Total Prize Purse	\$0
Individual Awards	2
Non-Monetary Incentives	Recognition, and the opportunity to work on a compelling, highly-visible international conservation issue
Operational Costs paid by Agency	Approximately 160 FTE hours.
Estimated Value of Partner Contribution	Approximately 100 personnel hours.
Estimated Investment Made by Solvers	NA

1. Problem Statement:

In November 2013, the USFWS destroyed approximately six tons of illegal elephant ivory – all seized as a result of law enforcement investigations and at U.S. ports of entry. The crush sent a clear message to ivory traffickers and their customers that the United States will not tolerate the illegal ivory trade. It was also designed to educate consumers and to urge them not to buy illegal ivory products.

Subsequently, the FWS, in partnership with the AZA, launched a global design challenge that sought creative ideas on how to use the 2013 crushed ivory to raise awareness and reduce the demand for illegal wildlife products.

2. Solution Type: Ideas

3. Proposed Goals

The primary goals of the competition, of equal importance, were to create a compelling, thought-provoking and informative tool to raise awareness and educate the public about the illegal wildlife trade, while enlisting the help of new people and communities to advance elephant conservation.

4. Goals Type

Solve a specific problem, namely, use crushed ivory to enhance conservation goals.

5. Measures of Success

- Does the design work to educate the public, inspire people to take action and work to reduce demand for elephant ivory and other illegal wildlife trade?
- Is the design feasible in terms of timing and budget?
- Does the design mitigate security/theft concerns?
- Does the design achieve the goal of not adding value to the crushed ivory?

6. Results

FWS announced the contest winners on May 9, 2016. A detailed list of measurable results will be available after the final designs have been constructed and distributed.

7. Participation Requirements

The Crushed Ivory Design Challenge was a global competition open to all U.S. and foreign citizens. It invited members of the public to create a compelling, thought provoking, informative, and impactful display to increase awareness about the fight against the illegal wildlife trade. Applicants included students, aspiring artists, conservationists and design professionals.

Forty-four applicants applied, mostly individuals from the United States.

8. Incentives

Participants were offered recognition, but no cash prize or monetary incentive. The AZA offered to assist with costs associated with fabricating the winning designs. The exact cost of fabrication is unknown at this time.

9. Evaluation and Judging

The agency appointed a panel of experts who judged submissions based on the following criteria:

- Does the design work to educate the public, inspire people to take action and work to reduce demand for elephant ivory and other illegal wildlife trade?
- Is the design feasible in terms of timing and budget?
- Does the design mitigate security/theft concerns?
- Does the design achieve the goal of not adding value to the crushed ivory?

The criteria were effective in identifying the potential challenge winners.

10. Partnerships

FWS partnered with AZA, which assisted with outreach by distributing information throughout their broad network of zoo and aquarium partners. AZA will also assist with the production of the award winner's designs and will help distribute the final products to zoos, aquariums, airports, schools and other public facilities, as appropriate.

11. Resources

The challenge required approximately 160 FTE hours from USFWS, approximately 100 personnel hours from our partners, and approximately 50 personnel hours from the contest panelists. Employee hours included internal and external meetings, developing and distributing outreach products and other projects as assigned. Partner hours included participating in internal meetings and assisting with FWS outreach products. Panel hours included reviewing and judging contest submissions. Effort on the part of contestants is not estimated.

Frequently-Used Acronyms

ACE	US Army Corp of Engineers
ACRA	America COMPETES Reauthorization Act of 2010
AZA	Association of Zoos and Aquariums
BLM	Bureau of Land Management
BSEE	Bureau of Safety and Environmental Enforcement
CRADA	Cooperative Research & Development Agreements
EPA	Environmental Protection Agency
FTE	Full time equivalent
FWS	Fish and Wildlife Service
NA	Not available
NASA	National Aeronautics & Space Administration
NCPC	National Capital Planning Commission
NOAA	National Oceanic & Atmospheric Administration
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
OESI	Ocean Energy Safety Institute
R&D	Research & Development
STEM	Science, Technology, Engineering and Mathematics
USACE	US Army Corps of Engineers
USGS	United States Geological Survey
WPCC	Water Prize Competition Center